

IN THE CLAIMS

1. (original) An apparatus for performing multi-cycle engine braking, said apparatus comprising:

exhaust valve operating means for operating at least one exhaust valve of an engine cylinder during a positive power engine operation;

intake valve operating means for operating at least one intake valve of the engine cylinder; and

braking means for operating the at least one exhaust valve of the engine cylinder during an engine braking operation, wherein said braking means accomplishes at least two braking operations for the at least one exhaust valve per engine cycle during the engine braking operation, wherein said intake valve operating means delays the operation of the at least one intake valve during the engine braking operation

2. (original) The apparatus according to claim 1, wherein said means for operating the at least one exhaust valve during the positive power engine operation includes an exhaust rocker arm.

3. (original) The apparatus according to claim 1, wherein said exhaust valve operating means includes exhaust valve engaging means for engaging the at least one exhaust valve to effectuate operation of the at least one exhaust valve.

4. (original) The apparatus according to claim 3, wherein said exhaust valve engaging means releasably engages a crosshead pin of the at least one exhaust valve.

5. (original) The apparatus according to claim 3, wherein said exhaust valve engaging means comprises a lash adjusting assembly.

6. (original) The apparatus according to claim 5, wherein said lash adjusting assembly is hydraulically operated.

7. (original) The apparatus according to claim 1, wherein said exhaust valve operating means disengages the at least one exhaust valve during the engine braking operation.

8. (original) The apparatus according to claim 1, wherein said intake valve operating means operates the at least one intake valve during the positive power engine operation.

9. (original) The apparatus according to claim 1, wherein said intake valve operating means includes an intake rocker arm.

10. (original) The apparatus according to claim 8, wherein said intake valve operating means includes intake valve engaging means for engaging the at least one

intake valve to effectuate operation of the at least one intake valve during the positive power engine operation.

11. (original) The apparatus according to claim 10, wherein said intake valve engaging means releasably engages a crosshead pin of the at least one intake valve.

12. (original) The apparatus according to claim 10, wherein said intake valve engaging means comprises a lash adjusting assembly.

13. (original) The apparatus according to claim 12, wherein said lash adjusting assembly is hydraulically operated.

14. (original) The apparatus according to claim 12, wherein said lash adjusting assembly retracts to a braking position during the engine braking operation such that the operation of the at least one intake valve is delayed.

15. (original) The apparatus according to claim 1, wherein said means for operating the at least one exhaust valve of the engine cylinder during the engine braking operation includes a brake rocker arm.

16. (original) The apparatus according to claim 1, wherein said brake rocker arm engages a crosshead pin for the at least one exhaust valve during the at least two engine braking operation.

17. (original) The apparatus according to claim 16, wherein said brake rocker arm disengages the crosshead pin during the positive power engine operation.

18. (original) The apparatus according to claim 1, wherein said braking means includes means to accomplish an exhaust gas recirculation event.

19. (original) A method of performing multi-cycle engine braking, said method comprising the steps of:

performing a first compression release event, wherein said first compression release event includes the steps of opening at least one exhaust valve to effectuate engine braking, and closing the at least one exhaust valve after predetermined time, wherein said step of opening the at least one exhaust valve to effectuate engine braking during said first compression release event is initiated prior to compression top dead center;

performing a second compression release event, wherein said second compression release event includes opening the at least one exhaust valve to effectuate engine braking, and closing the at least one exhaust valve after predetermined time, wherein said step of opening the at least one exhaust valve to

effectuate engine braking during said second compression release event is initiated prior to exhaust top dead center; and

delaying the opening of at least one intake valve for a predetermined time during engine braking.

20. (original) The method according to claim 19, further comprising the step of:

performing an exhaust gas recirculation event at the conclusion of said first compression release event.

21. (original) The method according to claim 19, wherein said step of opening at least one intake valve occurs after exhaust top dead center.

22. (previously presented) An assembly for operating an engine valve comprising:

a rocker shaft;

a rocker arm pivotally mounted on said rocker shaft, said rocker arm including a cavity at a valve actuation end;

an hydraulic lash adjuster slidably disposed in the rocker arm cavity;

an hydraulic passage provided in the rocker arm, said passage communicating with the rocker arm cavity; and

means for (a) selectively supplying hydraulic fluid to the passage during a positive power mode of engine operation and (b) venting hydraulic fluid from the passage during an engine braking mode of engine operation, wherein the engine braking mode comprises at least two braking operations.

23. (previously presented) The assembly of Claim 22, wherein said hydraulic lash adjuster comprises:

an outer plunger slidably received in the cavity; and

an inner plunger slidably received in the outer plunger.

24. (previously presented) The assembly of Claim 22, wherein said means for supplying and cutting off supply comprises a normally open three-way solenoid valve.

25. (previously presented) The assembly of Claim 22, wherein said means for supplying and cutting off supply is mounted on said rocker shaft.

26. (previously presented) The assembly of Claim 22, wherein said means for supplying and cutting off supply provides hydraulic fluid flow control for a plurality of lash adjusters.

27. (previously presented) A method of operating an engine valve lash adjuster in an internal combustion engine comprising the steps of:

determining that an engine is operating in a positive power mode;
selectively supplying hydraulic fluid to a lash adjuster in response to a
determination that the engine is operating in a positive power mode of operation;
determining that the engine is operating in an engine braking mode; and
venting hydraulic fluid from the lash adjuster in response to a determination that
the engine is operating in an engine braking mode of operation, wherein the engine
braking mode comprises at least two braking operations.

28. (previously presented) An engine valve actuation system for positive
power mode and compression brake mode engine operation, said system comprising:
a first rocker arm positioned to selectively actuate one or more valves associated
with an engine cylinder;
a first hydraulic lash adjuster operatively contacting the first rocker arm, said first
hydraulic lash adjuster being adapted to provide more lash during compression brake
operation than during positive power operation;
a second rocker arm positioned to selectively actuate at least one of the one or
more valves associated with the engine cylinder; and
a second hydraulic lash adjuster operatively contacting the second rocker arm,
said second hydraulic lash adjuster being adapted to provide more lash during positive
power operation than during compression brake operation,
wherein the compression brake operation comprises a first compression release
event and a second compression release event.

29. (previously presented) The system of Claim 28 wherein the first rocker arm is an exhaust rocker arm, and wherein the second rocker arm is a brake rocker arm.

30. (previously presented) The system of Claim 28 wherein the first rocker arm is an intake rocker arm, and wherein the second rocker arm is a brake rocker arm.

31. (previously presented) The system of Claim 28 further comprising a brake cam in operative contact with the second rocker arm, said brake cam having at least two compression-release lobes adapted to provide two-cycle engine brake operation.

32. (previously presented) The system of Claim 28 wherein the first hydraulic lash adjuster extends out of an end of the first rocker arm.

33. (previously presented) The system of Claim 32 wherein the second hydraulic lash adjuster extends out of an end of the second rocker arm.

34. (previously presented) The system of Claim 28 further comprising:
a third rocker arm positioned to selectively actuate one or more additional valves associated with the engine cylinder; and
a third hydraulic lash adjuster operatively contacting the third rocker arm, said

third hydraulic lash adjuster being adapted to provide more lash during compression brake operation than during positive power operation.

35. (previously presented) The system of Claim 34 wherein the third rocker arm is an intake rocker arm.

36. (previously presented) The system of Claim 34 further comprising a shared hydraulic supply circuit for the first hydraulic actuator and the third hydraulic actuator.

37. (previously presented) The system of Claim 28 further comprising a valve bridge between the first rocker arm and the one or more valves associated with the engine cylinder.

38. (previously presented) The system of Claim 37 further comprising means for actuating a valve through the valve bridge using the second rocker arm.

39. (previously presented) The system of Claim 34 further comprising a valve bridge between the third rocker arm and the one or more additional valves associated with the engine cylinder.

40. (previously presented) An engine valve actuation system for positive

power mode and two-cycle compression brake mode engine operation, said system comprising:

an exhaust rocker arm positioned to selectively actuate an exhaust valve;

a first hydraulic lash adjuster positioned between the exhaust rocker arm and the exhaust valve;

a brake rocker arm positioned to selectively actuate the exhaust valve; and

a second hydraulic lash adjuster positioned between the brake rocker arm and the exhaust valve.

41. (previously presented) The system of Claim 40 further comprising:
means for selectively providing hydraulic fluid to the first hydraulic lash adjuster during positive power mode operation; and

means for selectively providing hydraulic fluid to the second hydraulic lash adjuster during compression brake mode operation.

42. (previously presented) The system of Claim 41 wherein the first hydraulic lash adjuster extends out of an end of the exhaust rocker arm.

43. (previously presented) The system of Claim 42 wherein the second hydraulic lash adjuster extends out of an end of the brake rocker arm.

44. (previously presented) The system of Claim 40 further comprising a valve

bridge between the exhaust rocker arm and the exhaust valve.

45. (previously presented) The system of Claim 44 further comprising means for actuating the exhaust valve through the valve bridge using the brake rocker arm.

46. (previously presented) The system of Claim 40 further comprising a brake cam in operative contact with the second rocker arm, said brake cam having at least one compression-release lobe and at least one exhaust gas recirculation lobe.

47. (previously presented) The system of Claim 28 further comprising a brake cam in operative contact with the second rocker arm, said brake cam having at least one compression-release lobe and at least one exhaust gas recirculation lobe.

48. (previously presented) A method for positive power mode and compression brake mode engine valve actuation in a system having first and second rocker arms used to actuate an engine valve, said method comprising the steps of:
providing hydraulic fluid to a first lash adjuster associated with the first rocker arm and draining hydraulic fluid from a second lash adjuster associated with the second rocker arm during positive power mode;
actuating the engine valve with the first rocker arm during positive power mode;
providing hydraulic fluid to the second lash adjuster and draining hydraulic fluid from the first lash adjuster during compression brake mode; and

actuating the engine valve with the second rocker arm during compression brake mode,

wherein the compression brake mode comprises a first compression release event and a second compression release event.

49. (previously presented) The method of Claim 48 wherein the engine valve is actuated two times per engine cycle during compression brake mode near piston top dead center position to achieve two-cycle compression braking.

50. (previously presented) The method of Claim 48 wherein the engine valve is actuated to achieve exhaust gas recirculation during compression brake mode.